

EOS Science Networks Performance Report

This is a summary of EOS QA SCF performance testing for the 4th quarter of 2012 -- comparing the performance against the requirements, including Terra, TRMM, QuikScat, Aqua, Aura, ICESat, NPP, and GEOS requirements.

There are still several sites with requirements, but are not tested: University of Washington, JRC (Ispra, Italy), JAXA (Japan), and the University of Auckland, NZ.

Current results can be found on the EOS network performance web site (ENSIGHT): http://ensight.eos.nasa.gov/active_net_measure.html. Or click on any of the site links below.

Highlights:

- EBnet firewall upgraded in September
 - Packet Loss Decreased
 - Performance improved from EBnet Sources
- – Otherwise, performance was mostly stable
 - **All nodes rated at least Good** (all but one **Excellent!**)
 - **GPA 3.93** (same as last quarter)

Ratings:

Rating Categories:

Excellent	: median of daily worst cases > 3 x requirement
Good	: median of daily worst cases > requirement
Adequate	: median of daily worst cases < requirement and median of daily medians > requirement
Almost Adequate	: requirement > median of daily medians > requirement / 1.5 (i.e., below requirement, but above requirement without contingency)
Low	: median of daily medians < requirement / 1.5.
Bad	: median of daily medians < requirement / 3.

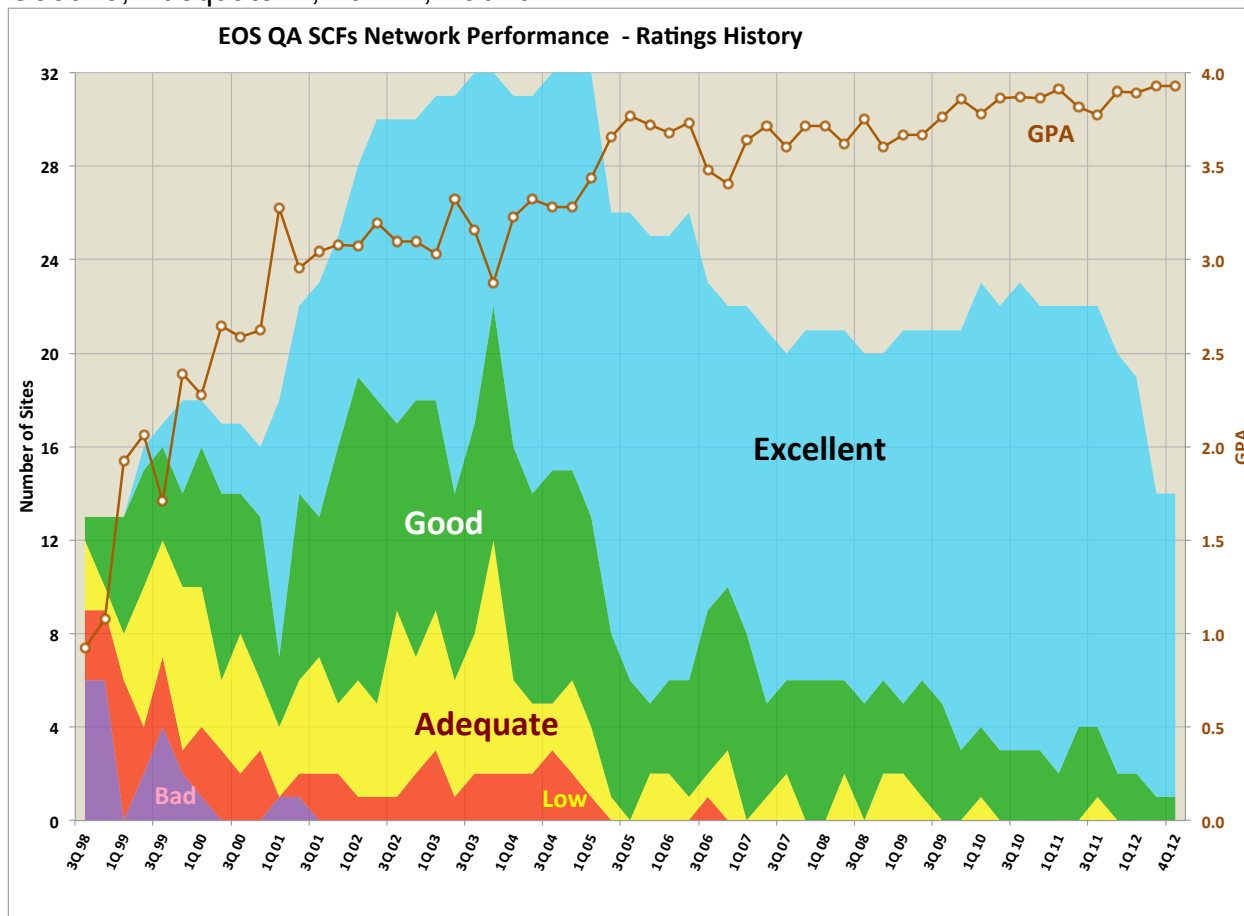
Ratings Changes:

Upgrades: ↑ None

Downgrades: ↓ None

Ratings History:

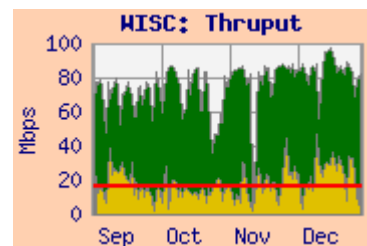
The chart below shows the number of sites in each classification since the testing started in 1998. Note that these ratings do NOT relate to absolute performance -- they are relative to the EOS requirements. The GPA is calculated based on Excellent: 4, Good: 3, Adequate: 2, Low: 1, Bad: 0



Notes: The number of sites included in this chart has changed since 1Q'05 due to:

- 2Q05: Moving the reporting for 6 SIPS sites to the "EOS Production Sites" Network Performance Report.
- 2006: Testing discontinued to SAGE III Nodes, NOAA, UMD, UIUC
- 2Q07: Testing discontinued to U Washington
- 1Q09: Testing added to BADC (RAL).
- 2010: Testing to Oxford restored, ICESAT functions of Ohio State were transferred to Buffalo, testing to Buffalo added, Testing to Ohio State discontinued.
- 3Q10: UIUC added [back]; Testing to MIT discontinued
- 2Q11: Testing discontinued to LANL, PNNL; requirements added to CCRS and Univ of Auckland
- 4Q11: Testing to JRC discontinued, Wisconsin moved to production sites report.
- 1Q12: Testing to Univ Auckland, NZ failing.
- 2-3Q12: Discontinued testing to Arizona, UCSD, Colo State, Miami, Montana, SUNY SB, and Buffalo – no longer any requirements. Added testing to Hawaii, ORNL.

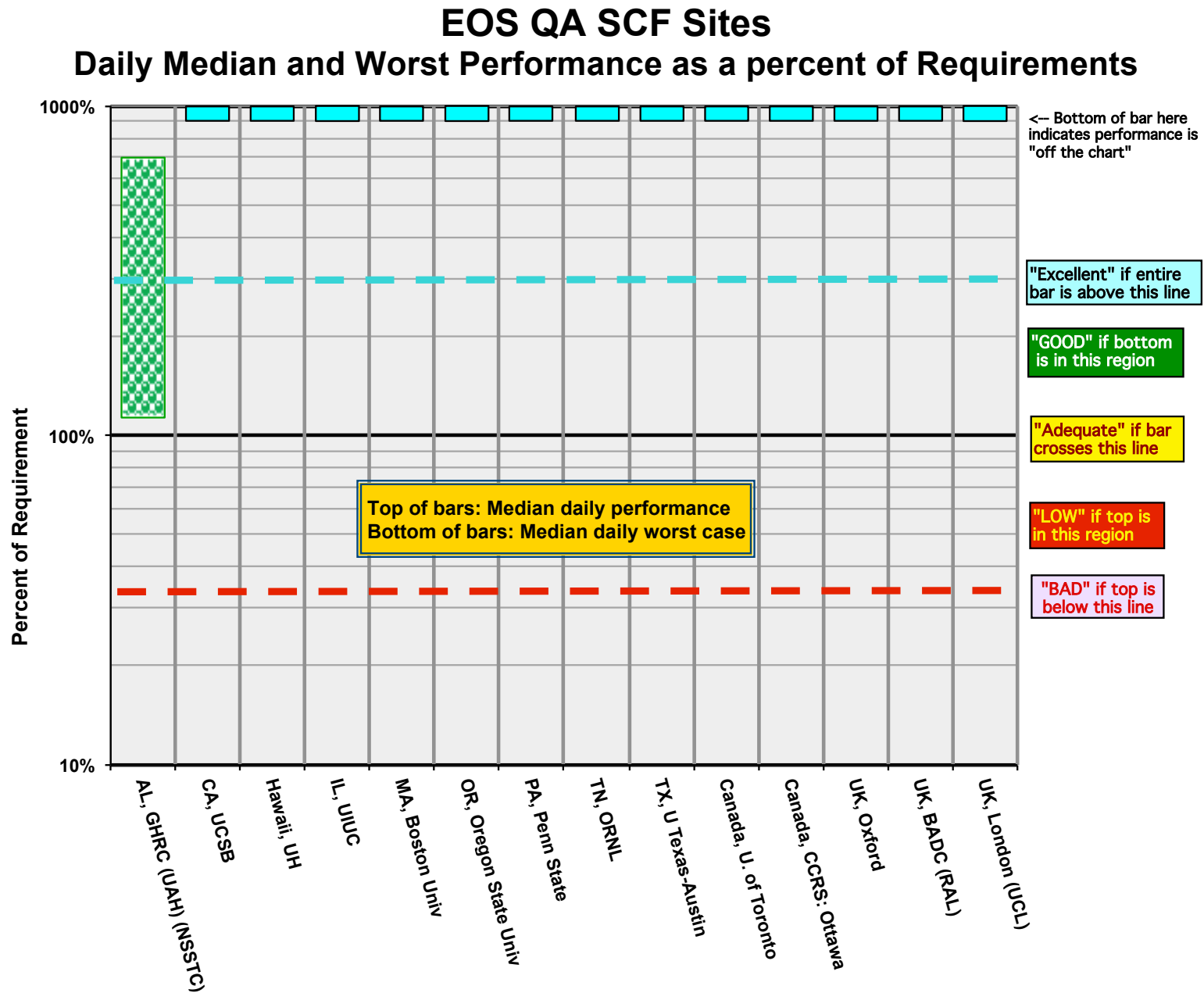
Integrated Charts: Integrated charts are now included for selected sites with the site details. These charts are “Area” charts, with a pink background. A sample Integrated chart is shown here. The yellow area at the bottom represents the daily average of the user flow from the source facility (e.g., GSFC, in this example) to the destination facility (e.g., Wisconsin, in this example) obtained from routers via “netflow”. The green area is stacked on top of the user flow, and represents the “adjusted” daily average iperf throughput between the source-destination pair most closely corresponding to the requirement. This iperf measurement essentially shows the circuit capacity remaining with the user flows active. The adjustments are made to compensate for various systematic effects, and are best considered as an approximation. The red line is the requirement for the flow from the source to destination facilities.



Note: User flow data is has not been available from LaRC since March 2007, so sites with primary requirements from LaRC will not include integrated graphs. (But JPL $\leftarrow \rightarrow$ LaRC flow data is available from JPL, and GSFC $\leftarrow \rightarrow$ LaRC is available from GSFC).

EOS QA SCF Sites Summary: Network Requirements vs. Measured Performance

4 th Quarter 2012				Testing							
Destination	Team (s)	Requirements		Source Node	Median Daily Best	Median mbps	Median Daily Worst	Average User Flow	Rating re Current Requirements		
		Database	Nov-07						4 Q 2012	2-3 Q12	
AL, GHRC (UAH) (NSSTC)	MODIS, LANCE	2.9	6.9	GSFC-EDOS	35.6	20.2	3.3		Good	Good	NISN - MAX - Internet2 - SOX - UAH
CA, UCSB	MODIS	0.17	3.1	GSFC-MODIS	155.0	153.7	142.2	0.33	Excellent	Ex	EBnet - MAX - Internet2 - CENIC
Hawaii, UH	MODIS	0.02		GSFC-ENPL	766.9	639.6	598.8		Excellent	Ex	EBnet - MAX - Internet2 - LA
IL, UIUC	MISR	0.56	1.1	LaRC PTH	184.6	183.1	173.4		Excellent	Ex	NISN - MAX - Internet2 - StarLight (Chicago)
MA, Boston Univ	MODIS, MISR	2.6	3.0	GES DISC	360.8	233.6	122.7	1.2	Excellent	Ex	StarLight (Chicago) - Internet2 - NOX
OR, Oregon State Univ	CERES, MODIS, MISR	0.7	7.6	LaTIS	114.9	114.1	113.5		Excellent	Ex	NISN - MAX - Internet2 - PNW
PA, Penn State	MISR	0.6	2.6	LaRC PTH	59.3	58.1	50.8		Excellent	Ex	NISN - MAX - 3ROX
TN, ORNL	MODIS	10.1		GSFC-ENPL	2347.7	2329.4	2235.1		Excellent	Ex	MAX - ESnet
TX, U Texas-Austin	MODIS	0.7	11.1	GSFC-ESDIS-PTH	278.6	276.7	275.2	0.2	Excellent	Ex	NISN - MAX - Internet2 - TX-learn
WA, U Washington	MISR	2.4	2.4	LaRC DAAC	n/a	n/a	n/a				Internet2 via NISN / MAX
Canada, U. of Toronto	MOPITT, GEOS	0.1	0.6	LaRC DAAC	60.7	59.7	34.3		Excellent	Ex	NISN - StarLight (Chicago) - CA*net
Canada, CCRS: Ottawa	CEOS, MODIS	1.1	3.8	GSFC-MODIS	130.7	129.7	127.0	3.8	Excellent	Ex	EBnet - MAX - Internet2 - CA*net
Italy, Ispra (JRC)	MISR	9.7	0.1	LaRC DAAC	n/a	n/a	n/a				NISN / MAX / Géant (DC) / GARR
Japan, JAXA	MODIS, PPS	3.5	0.5	GSFC-MODIS	n/a	n/a	n/a				EBnet - MAX - Internet2 - LA - TransPAC
New Zealand, U Auckland	MISR	0.3	0.3	LaRC PTH	n/a	n/a	n/a				NISN - StarLight (Chicago) - PNW - PacWave
UK, Oxford	HIRDLS	0.4	0.5	GSFC-ENPL-PTH	897.1	865.7	431.7	0.33	Excellent	Ex	MAX - Géant (DC) - JAnet
UK, BADC (RAL)	HIRDLS	0.2	0.2	GSFC-ESDIS-PTH	27.5	24.3	19.8		Excellent	Ex	EBnet - MAX - Géant (DC) - JAnet
UK, London (UCL)	MISR, MODIS	0.6	1.0	LaRC PTH	36.2	33.1	11.0		Excellent	Ex	NISN - MAX - Géant (DC) - JAnet
								Summary			
	*Rating Criteria:								Current:	Prev	
								Rating	4 Q 2012	Report	
Excellent	Median Daily Worst >= 3 * Requirement							Excellent	13	13	
Good	Median Daily Worst >= Requirement							Good	1	1	
Adequate	Median Daily Worst < Requirement <= Median Daily Median							Adequate	0	0	
LOW	Median Daily Median < Requirement							LOW	0	0	
BAD	Median Daily Median < Requirement / 3							BAD	0	0	
								Total	14	14	
								GPA	3.93	3.93	



Details on individual sites:

Each site listed below is the DESTINATION for all the results reported in that section. Other tests are also listed. The three values listed are derived from [nominally] 24 tests per day. For each day, a daily best, worst, and median is obtained. The values shown below are the medians of those values over the test period.

1) AL, GHRC (UAH) (aka NSSTC)

Teams: AMSR, MODIS, LANCE

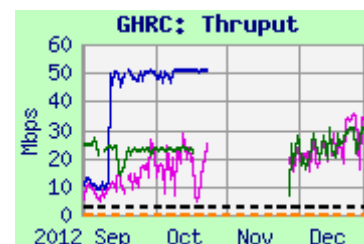
Web Page: <http://ensight.eos.nasa.gov/Missions/terra/NSSTC.shtml>

Rating: Continued **Good**

Domain: nsstc.uah.edu

Test Results:

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
GSFC-EDOS	35.6	20.2	3.3	MAX / I2 / SOX
GSFC-EDOS	51.2	50.7	35.9	NISN
LaRC-PTH	30.3	23.2	7.7	NISN / MAX / I2 / SOX



Requirements:

Source Node	FY	Mbps	Rating
MODIS	'12 –	2.9	Good

Comments: Testing was initiated in December '10 from GSFC-EDOS via both NISN and Internet2 for LANCE flows. There is no longer a CERES requirement (was 6.9 mbps) from LaRC. Testing between GHRC, RSS and NSIDC for AMSR-E (AQUA) is now in the "Production Sites" report. Testing from EDOS via NISN was suspended in October while a new NISN host was sought.

The median daily worst case from EDOS via I2 was above the MODIS requirement, but by less than 3 x so the rating remains **Good**.

2) CA, UCSB :

Teams: MODIS

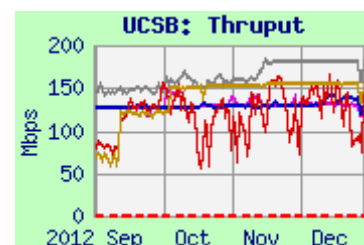
Web page: <http://ensight.eos.nasa.gov/Missions/terra/UCSB.shtml>

Ratings: GSFC: Continued **Excellent**

Domain: ucsb.edu

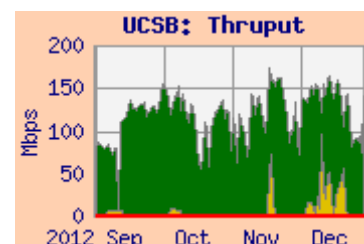
Test Results:

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
GSFC-MODIS	155.0	153.7	142.2	MAX / I2 / CENIC
GSFC-GES DISC	159.4	125.3	50.3	
GSFC-ENPL	133.2	130.4	126.8	
EROS-LPDAAAC	134.6	129.2	125.1	StarLight / I2 / CENIC
EROS-PTH	180.2	168.6	144.8	



Requirements:

Source Node	FY	kbps	Rating
GSFC	'12 -	170	Excellent



Comments: The GSFC requirement was reduced (was 3.1 mbps), and the EROS requirement was eliminated (was 2.2 mbps).

Thruput from all sites is pretty stable. The rating from GSFC-MODIS remains **Excellent**. The user flow from GSFC averaged 8.5 mbps this period, much higher than typical and both the old and new requirements. The user flow from EROS averaged 0.33 mbps this period, well below the old requirement.

Performance from EROS-LPDAAAC and EROS-PTH improved in August with a switch to the EROS production server, outside the firewall, and from EBnet (GSFC-MODIS and GSFC-GES DISC) in September due to the EBnet firewall upgrade.

3) HI, University of Hawaii:

Team: MODIS

Web Page: <http://ensight.eos.nasa.gov/Missions/terra/HAWAII.shtml>Ratings: GSFC: **Excellent**
Domain: uhnet.net**Test Results:**

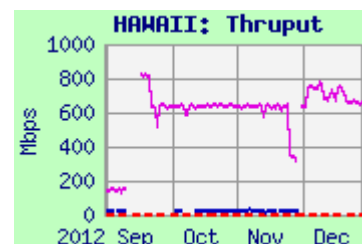
Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
GSFC-ENPL	766.9	639.6	598.8	MAX / I2 / LA / UHnet

Requirements:

Source Node	FY	kbps	Rating
GSFC-MODIS	'12 –	21	Excellent

Comments: Testing was initiated to a PerfSonar node at UH in April, based on a [very small] MODIS requirement in the new ICD. Performance from GSFC-ENPL improved in September when testing was switched to a better PerfSonar node in Hawaii.

The throughput is much more than the tiny requirement, so the rating is **Excellent**

**4) IL, UIUC:**

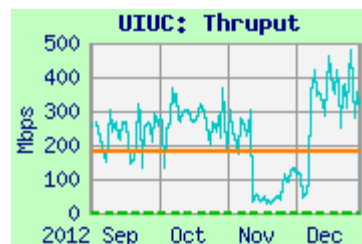
Teams: MISR

Web page: <http://ensight.eos.nasa.gov/Missions/terra/UIUC.shtml>Rating: LaRC: **Excellent**
Domain: uiuc.edu**Test Results:**

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
LaRC PTH	184.6	183.1	173.4	NISN / StarLight / I2
GSFC-NISN	434.6	269.3	81.8	MAX / I2

Requirements:

Source Node	FY	kbps	Rating
LaRC ASDC	'12 -	556	Excellent



Comments: Testing was added to UIUC in August '10. Initially, SCP testing was initiated from GSFC and LaRC, sending files to UIUC. SCP throughput was noisy from both sources, somewhat bimodal.

In October '10, nuttcp testing was added, initiated by UIUC, receiving from GSFC and LaRC. Throughput on these tests is steadier than SCP, but much lower, apparently due to significant incoming packet loss (which is causing the noisiness on the SCPs as well).

In March 2012, testing from GSFC-NISN and LaRC PTH was switched to a PerfSonar server at UIUC, with greatly improved throughput. The SCP tests were discontinued in May. The throughput on the PerfSonar tests was well above the revised requirement (was 1.1 mbps previously); the rating remains **Excellent**.

5) MA, Boston Univ:

Teams: MODIS, MISR

Domain: bu.edu

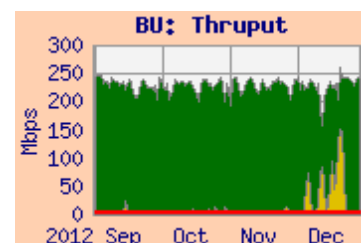
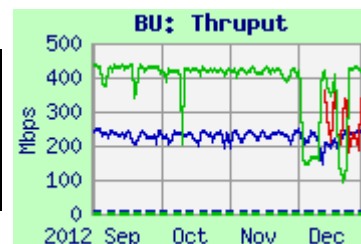
Web Page: <http://ensight.eos.nasa.gov/Missions/terra/BU.shtml>Ratings: EROS: Continued **Excellent**
LaRC: Continued **Excellent****Test Results:**

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
EROS LPDAAC	249.1	229.4	137.4	StarLight / I2 / NOX
GSFC GES DISC	360.8	233.6	122.7	MAX / I2 / NOX
LaRC ASDC	428.7	416.6	155.1	NISN / MAX / I2 / NOX

Requirements:

Source Node	FY	mbps	Rating
EROS LPDAAC	'12 -	2.6	Excellent
LaRC ASDC DAAC	'12 -	0.7	Excellent

Comments: BU is well connected. Thruput from all sources was stable, and much better than the [revised lower, was 3.0 mbps] requirements, rating "**Excellent**". From EROS LPDAAC, the user flow (shown on the integrated graph) averaged about 15 mbps for this period – due to a large burst in December. Thruput from GSFC and LaRC ASDC DAAC also greatly exceeded the requirements. User flow from GSFC was about 1.2 mbps.

**6) OR, Oregon State Univ:**

Teams: MISR

Ratings: LaRC ANGe: Continued **Excellent**

Domain: oce.orst.edu

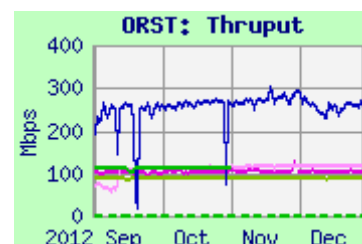
Web Page: <http://ensight.eos.nasa.gov/Missions/terra/ORST.shtml>**Test Results:**

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
LaRC ANGe	114.9	114.1	113.5	NISN / MAX / I2 / PNW
JPL	277.6	263.4	219.4	CENIC / I2 / PNW
GSFC-ESDIS-PTH	117.7	115.6	113.0	MAX / I2 / PNW
GSFC-ENPL	108.2	104.8	99.1	

Requirements:

Source Node	FY	kbps	Rating
LaRC ANGe	'12 -	694	Excellent
GES DISC	'02 – '11	250	Excellent

Comments: The requirements were reduced (was 7.6 mbps from LaRC) since the requirements for CERES and MODIS have been eliminated. Thruput was mostly stable from all sources for this period, and was well above the requirements. The rating from LaTIS remains "**Excellent**". Results from the East coast sites are limited by a small window size at ORST. Thruput from GSFC-ESDIS-PTH improved in September, with the EBnet firewall upgrade.



7) PA: Penn State Univ:

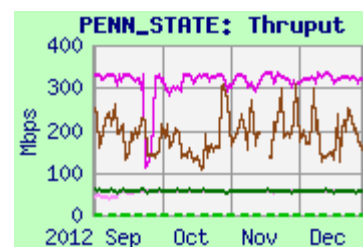
Team: MISR

Web Page: http://ensight.eos.nasa.gov/Missions/terra/PENN_STATE.shtmlRating: Continued **Excellent**

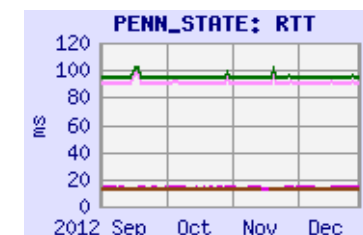
Domain: psu.edu

Test Results:

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
LaRC-PTH	59.3	58.1	50.8	NISN / MAX / I2 / 3ROX
GSFC-ESDIS-PTH	56.8	56.0	52.5	MAX / I2 / 3ROX
GSFC-ENPL	331.6	321.2	285.0	
GSFC-ESTO	248.5	187.6	133.1	

**Requirements:**

Source Node	FY	kbps	Rating
LaRC DAAC	'03 -	556	Excellent



Comments: Thruput from NISN sources is much lower than from non-NISN sources, due to much longer RTT. Note that the forward route (to PSU) is OK (see above), but the return route to LaRC and GSFC-ESDIS-PTH is much longer -- now via peering with NISN in Chicago! But due to the low [reduced from 2.6 mbps] requirement, the rating remains **Excellent**.

Thruput from GSFC-ESDIS-PTH dropped in February 2012, due to EBnet packet loss, and improved in September, with the EBnet firewall upgrade.

From GSFC-ESTO (on the SEN at GSFC, not EBnet) and from GSFC-ENPL (direct GigE to MAX), the RTT is lower (due to the optimum return route), and the thruput is much higher than from other sources.

8) TN, Oak Ridge National Lab:

Teams: MODIS, DAAC

Web Page: <http://ensight.eos.nasa.gov/Missions/terra/ORNL.shtml>Rating: GSFC: **Excellent**

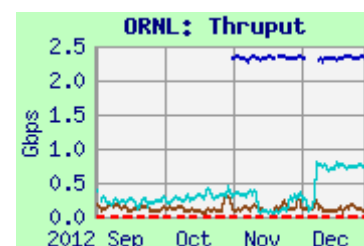
Domain: ornl.gov

Test Results:

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
GSFC-NISN	503.5	305.1	168.8	NISN / MAX / ESnet
GSFC-ENPL-PS	2347.7	2329.4	2235.1	MAX / ESnet
GSFC-ESTO	169.1	114.7	83.3	MAX / ESnet

Requirements:

Source Node	FY	mbps	Rating
GSFC	'12 -	10.1	Excellent



Comments: Testing was added in October from GSFC-ENPL-PS, a 10 gig connected PerfSonar node at GSFC, to the PerfSonar node at ORNL, with excellent, steady thruput. Thruput stabilized from GSFC-NISN in December.. Performance was well above the requirement; the rating is therefore **Excellent**.

9) TX: Univ. of Texas - Austin:

Team: MODIS, ICESAT

Web Page: <http://ensight.eos.nasa.gov/Missions/icesat/TEXAS.shtml>Rating: Continued **Excellent**

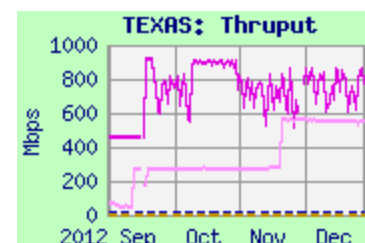
Domain: utexas.edu

Test Results:

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
GSFC-ENPL-PTH	910.4	778.4	590.4	MAX / I2 / TX
GSFC-ESDIS-PTH	278.6	276.7	275.2	

Requirements:

Source Node	FY	kbps	Rating
GSFC-MODIS	'12 -	666	Excellent



Comments: Thruput from ICESAT was mostly steady, and well above the previous 10 mbps requirement. The previous 11.1 mbps ICESAT requirement has been eliminated, however, and testing from ICESAT discontinued.

Thruput from GSFC-ESDIS-PTH dropped in late February, due to EBnet packet loss, and improved in September, with the EBnet firewall upgrade, and was retuned in November. Even before these improvements, the thruput was well above 3 x the MODIS requirement, so the rating remains **Excellent**.

From GSFC-ENPL, outside most of the congested GSFC campus infrastructure, thruput is less noisy. This test was moved to a PerfSonar node at UT in August, and retuned in September, with greatly improved results. [The test from ESDIS-PTH remains to the SCF].

The average user flow this period was only 160 kbps, about 25% of the MODIS requirement.

10) Canada, Univ of Toronto:

Team: MOPITT

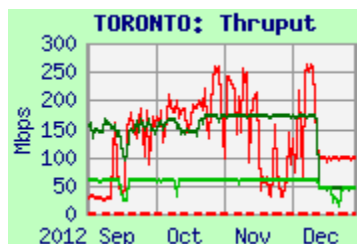
Domain: utoronto.ca

Web Page: <http://ensight.eos.nasa.gov/Missions/terra/TORONTO.shtml>Rating: GSFC: Continued **Excellent**LaRC: Continued **Excellent****Test Results:**

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
LaRC ASDC DAAC	60.7	59.7	34.3	NISN / StarLight / CA*net
LaRC PTH	172.7	170.8	123.7	
GSFC-ESDIS-PS	249.6	155.0	37.9	MAX / I2 / NY / CA*net

Requirements:

Source Node	FY	kbps	Rating
LaRC DAAC	'02 -	100	Excellent
GSFC EOC	'02 -	512	Excellent



Comments: Thruput from LaRC ASDC DAAC dropped in late April due to problems at ASDC. Other destinations dropped similarly from LaRC ASDC at the same time; however, no such drop was observed from LaRC PTH, indicating that the problem was not a WAN problem but was local to LaRC ASDC.

Testing from GSFC-ESDIS-PS dropped in late February 2012, due to EBnet packet loss, and improved in September, with the EBnet firewall upgrade.

The ratings from both sources remain **Excellent**, due in part to the low requirements.

User flow from GSFC averaged only 1 kbps this period.

11) Canada: CCRS (Ottawa)

Teams: MODIS, CEOS

Web Page: <http://ensight.eos.nasa.gov/Missions/terra/CCRS.shtml>Rating: Continued **Excellent**Domain: ccrs.nrcan.gc.ca**Test Results:**

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
GSFC-MODAPS	130.7	129.7	127.0	MAX / I2 / CA*net
GSFC-ENPL	134.1	132.2	117.2	

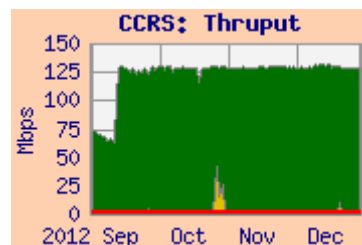
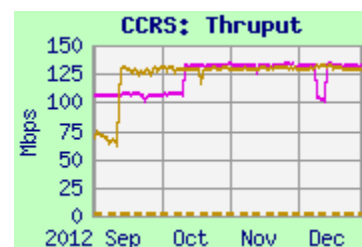
Requirement:

Source Node	FY	mbps	Rating
GSFC-MODAPS	'11 -	1.1	Excellent

The MODIS requirement was reduced from 3.8 mbps previously.

Thruput from GSFC-MODAPS dropped in late February 2012, due to EBnet packet loss, and improved in September, with the EBnet firewall upgrade. It remained much more than 3 x the requirement, so is rated **Excellent**.

User flow from GSFC averaged 3.8 mbps this period, above the current requirement, but equal to the previous requirement.

**12) UK, Oxford Univ.:**

Team: HIRDLS

Web Page: <http://ensight.eos.nasa.gov/Missions/aura/OXFORD.shtml>Rating: Continued **Excellent**Domain: ox.ac.uk**Test Results:**

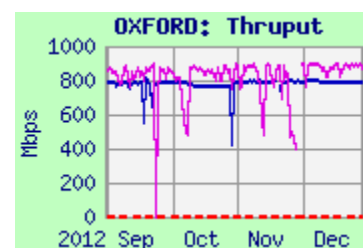
Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
GSFC-ENPL	897.1	865.7	431.7	MAX / I2 / Géant (DC) / JAnet
GSFC-ENPL-PS	802.4	787.9	450.5	

Requirements: (IST Only)

Source Node	FY	kbps	Rating
GSFC	'03 -	368	Excellent

Comments: Beginning in late March 2012, testing was switched to a PerfSonar server at Oxford, using iperf. Testing previously had used, "flood pings", which is a poor substitute for iperf, and provided much lower results. Performance improved again in June when the Oxford PerfSonar node was upgraded. The rating continues **Excellent**.

User flow from GSFC to Oxford averaged only 330 kbps for this period, very close to the requirement and the previous period.



13) UK, London: (University College)Rating: Continued **Excellent**

Teams: MODIS, MISR

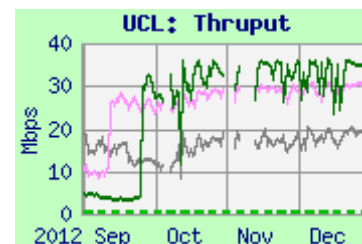
Domain: ucl.ac.uk

Web Page: <http://ensight.eos.nasa.gov/Missions/terra/UCLSCF.shtml>**Test Results:**

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
LaRC PTH	36.2	33.1	11.0	NISN / MAX / Géant / JAnet
GSFC-ESDIS-PTH	32.0	28.7	18.5	MAX / I2 / Géant (DC) / JAnet
EROS-PTH	21.3	16.9	7.7	StarLight / I2 / Géant (DC) / JAnet

Requirements

Source Node	FY	kpbs	Rating
LaRC DAAC	'12 –	556	Excellent



Comments: Testing since November and December '10 is by nuttcp pulls, initiated at UCL.

NISN began peering with Géant in September '09, with improved throughput from LaRC. Previously, the route from LaRC was via NISN peering with Teleglobe on the US west coast, unnecessarily increasing RTT and reducing throughput.

The median daily worst throughput from LaRC remained well above 3 x the requirement, so the rating remains **Excellent**.

From GSFC-ESDIS, performance dropped in late February 2012, due to EBnet packet loss, and improved in September, with the EBnet firewall upgrade.

Throughput from EROS is pretty stable, but lower than the other sites, due to a longer RTT.

14) British Atmospheric Data CentreRating: Continued **Excellent**

(Rutherford Appleton Laboratory)

Team: HIRDLS

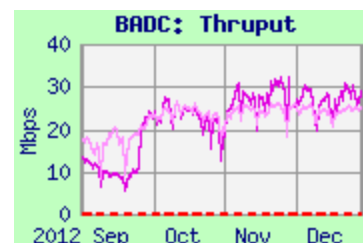
Domain: rl.ac.uk

Web Page: http://ensight.eos.nasa.gov/Missions/aura/UK_RAL.shtml**Test Results:**

Source Node	Medians of daily tests (mbps)			Route
	Best	Median	Worst	
GSFC-ENPL	33.7	25.8	17.2	MAX / I2 / Géant (DC) / JAnet
GSFC-ESDIS-PTH	27.5	24.3	19.8	

Requirements:

Source Node	FY	kpbs	Rating
GSFC	'02 –	190	Excellent



Comments: Throughput from GSFC-ENPL was similar to that from GSFC-ESDIS-PTH. The throughput has consistently been much higher than the requirement, so the rating remains **Excellent**.